

Skewed results: Can diagonal arrays maintain/improve performance?

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Introduction

Array designs aim to pack as many modules as reasonably possible into the available land area. Since a north-south tracker alignment yields the greatest production, array layouts normally use this orientation. However, local survey lines may run at a different angle, creating arrays with ragged edges and inefficient use of space. Here we ask whether aligning the trackers with the parcel boundaries makes sense in terms of energy production: How much production is lost at a given angle away from north-south alignment? Can more efficient tracker packing make up for this difference?

System Designs

As an example, we use a strip of land that was available near a site in southeastern US that was considered for PV+BESS development. The boundaries of this strip run at an angle of 9.4° from N-S and space was clearly lost by forcing trackers to fit at the east and west edges. Two scenarios were designed to explore more efficient use of this space.

Since array packing is most affected by geometric parameters, we created two designs with different tracker lengths and pitches.

Design 1

Module	Inverter	Pitch/GCR	Trackers
First Solar 465 W	SMA 4200 kW	6.13 m 0.33	81.0 m 112.6 m

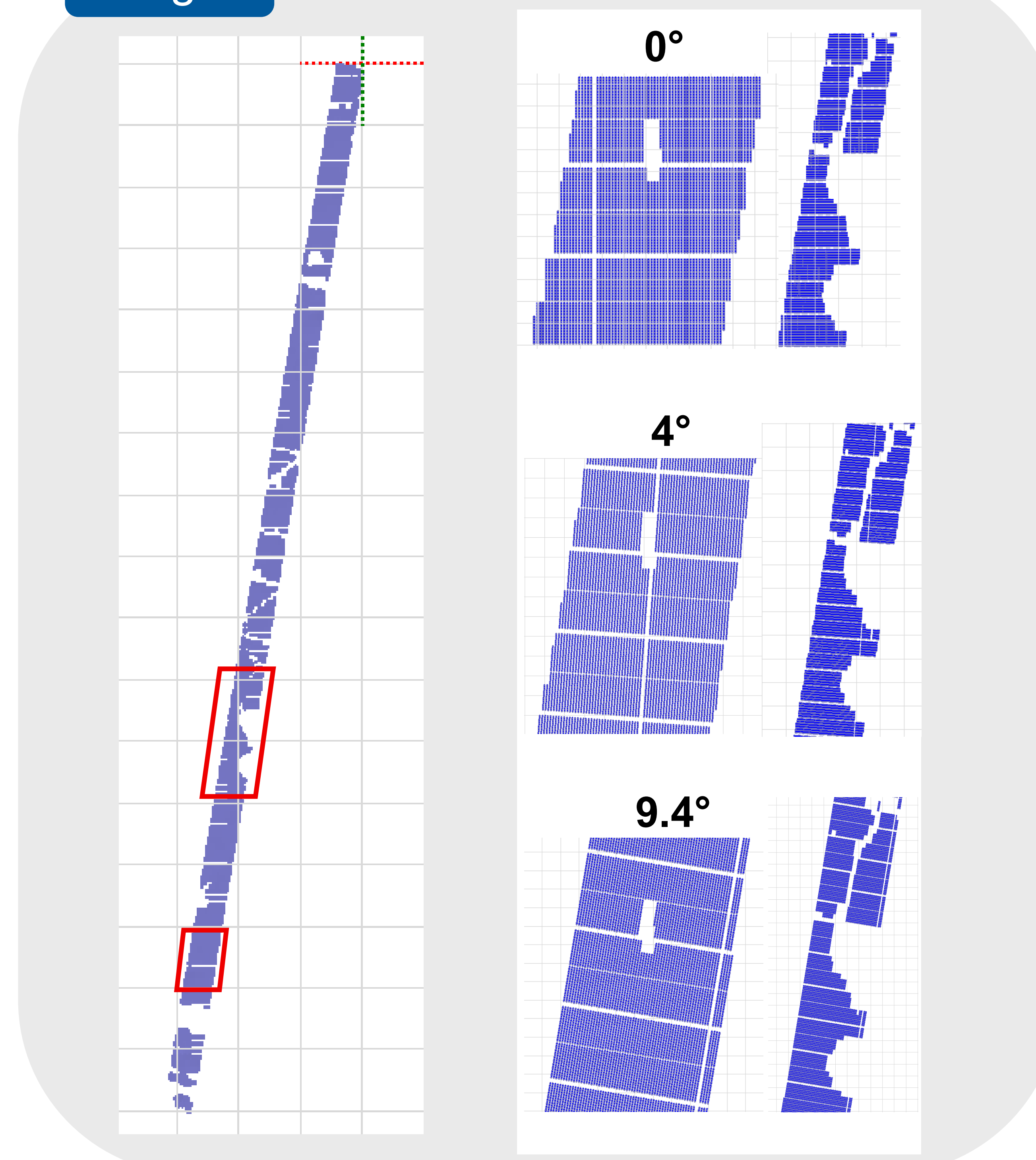
Design 2

Module	Inverter	Pitch/GCR	Trackers
Boviet 550 W	SMA 4400 kW	6.90 m 0.33	65.4 m 97.1 m

Method

- Five scenarios were created for each design by using CAD autofill to fill the available area with trackers at five different angles running from N-S (0°) to 9.4°. These scenes were imported into PVsyst.
- To isolate the effect of rotation, PVsyst was first run for each scene using the system setup of the 0° layout, i.e., with fixed module and inverter count.
- PVsyst was run a second time using the actual module count and corresponding number of inverters from the CAD autofill to ascertain how much more production could be gained if the maximum number of modules was installed.
- The amount of space that could be saved by installing the original number of modules in this orientation was calculated from the production increase.

Design 1



Design 1 Results

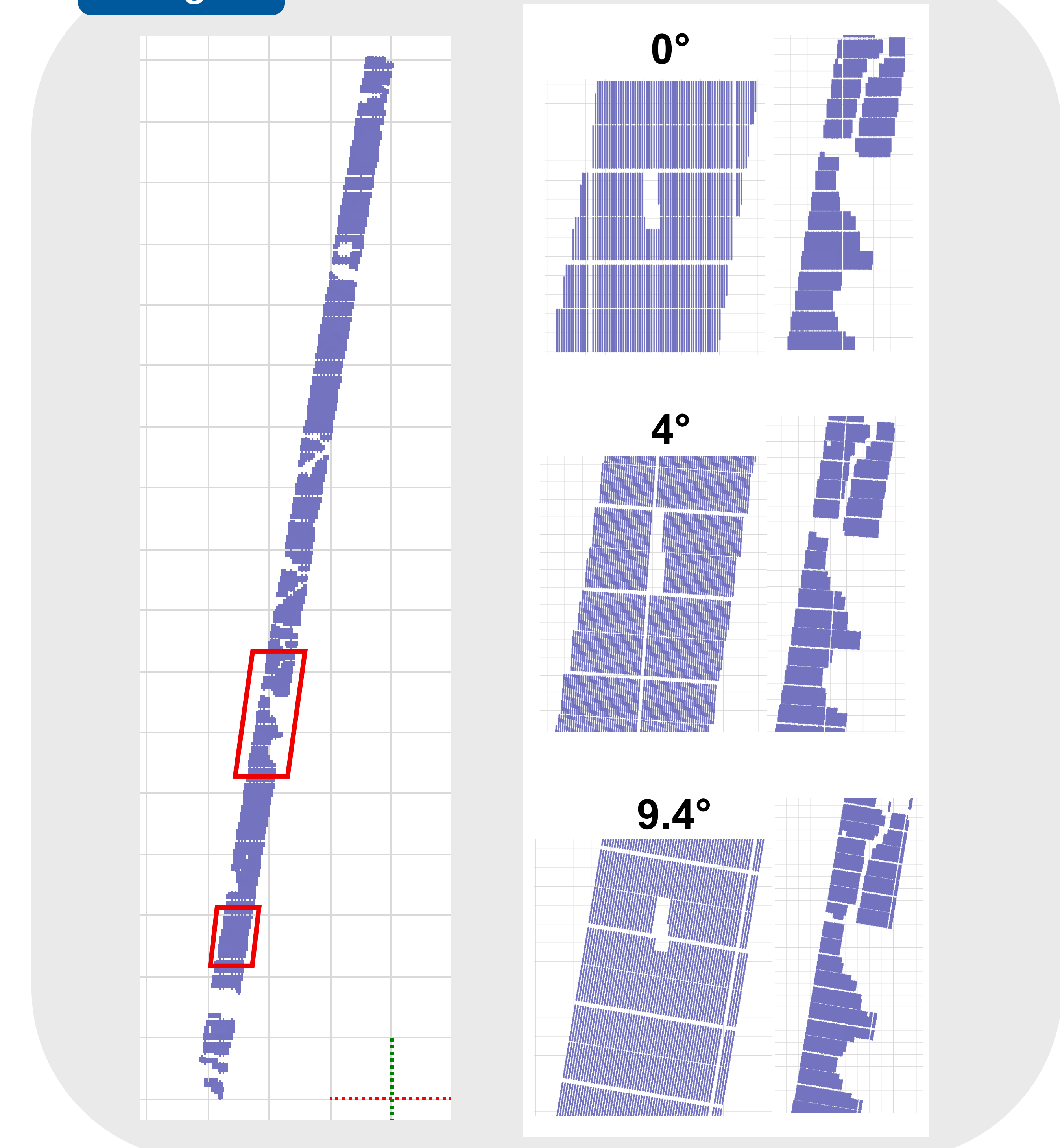
Angle	N mod	MWdc	P50 (MWh)	Diff. (MWh)	Rel. Diff.
0°	648,156	301.39	569,968	-	-
2°	648,156	301.39	569,970	2	0.00%
4°	648,156	301.39	569,636	-332	-0.06%
7°	648,156	301.39	568,957	-1,011	-0.18%
9.4°	648,156	301.39	568,441	-1,527	-0.27%

Angle	N mod	MWdc	Rel. Diff.	P50 (MWh)	Rel. Diff.	Land Saved
0°	648,156	301.39		569,968		
2°	653,676	303.96	0.85%	575,131	0.91%	-0.84%
4°	659,004	306.44	1.67%	579,029	1.59%	-1.65%
7°	666,552	309.95	2.84%	585,126	2.66%	-2.76%
9.4°	671,700	312.34	3.63%	589,448	3.42%	-3.51%

Conclusions

- Rotation of trackers as far as off of North-South lowered production by less than 0.3%.
- Better tracker packing allows a larger number of modules in the array or a reduction of land much larger than the rotation loss.

Design 2



Design 2 Results

Angle	N mod	MWdc	P50 (MWh)	Diff. (MWh)	Rel. Diff.
0°	651,888	358.54	681,807	-	-
2°	651,888	358.54	681,771	-36	-0.01%
4°	651,888	358.54	681,699	-108	-0.02%
7°	651,888	358.54	680,685	-1,122	-0.16%
9.4°	651,888	358.54	680,064	-1,743	-0.26%

Angle	N mod	MWdc	Rel. Diff.	P50 (MWh)	Rel. Diff.	Land Saved
0°	651,888	358.54		Rel. Diff.		
2°	656,262	360.94	0.67%	686,747	0.72%	-0.69%
4°	664,551	365.50	1.94%	695,361	1.99%	-1.98%
7°	670,734	368.90	2.89%	700,067	2.68%	-2.92%
9.4°	679,725	373.85	4.27%	708,767	3.95%	-4.26%

Acknowledgements

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